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NOTES ON THE MANUFACTURE OF RUBBER GOODS.

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The following notes on the manufacture of vulcanised rubber articles may prove of interest to those planters who may be desirous of gaining some knowledge of the subsequent treatment and ultimate fate of this valuable raw agricultural product which is now such an important export from this and other eastern tropical countries.

Although the description of the various methods of manufacture of vulcanised articles referred to in these notes is derived from observations made by the writer during visits to five of the leading factories in Europe, these methods have been described to a greater or less extent in various text-books and journals so that no secrets of any particular factory or process will be divulged.

As a matter of fact, secret processes in rubber works are almost entirely connected with special mixings or special methods of vulcanising, as to time, pressure, etc., and there is no secrecy in the general methods employed, which are very similar in every factory for each particular article.

It would be impossible too, except by accident, to discover any secret process in a factory unless a prolonged period were spent in the works.

In the manufacture of mechanical goods, which comprise such a large part of the rubber trade, and in which, in addition to the admixture of sulphur for vulcanising purposes, a large proportion of mineral ingredients, rubber substitute and reclaimed rubber, is added, the separate processes to which the raw rubber, after washing and drying, is subjected, are as follows:—(1) Mixing with sulphur alone or with the addition of other substances between hot rollers running at differential speeds, till a homogeneous plastic mixture is obtained. (2) Calendering between even speed rollers, in order to obtain a thin sheet of the plastic mixture free from air bubbles, etc., which

can be subsequently used for building up sheets of any desired thickness. (3) Vulcanising or "curing," which consists essentially in subjecting the moulded article to an elevated temperature for a definite period under pressure, according to the nature of the mixing and the article required.

All vulcanised rubber goods contain more or less sulphur in the mixing, with or without other ingredients depending on the quality, etc., of the goods to be made.

The processes of washing and drying raw rubber have been described in the previous issue. The absence of moisture in the final dry crepe (a maximum of about 0.2 per cent being allowed) is very important, in order to avoid defects such as porosity or sponginess in the vulcanised material.

The manufacture of certain surgical goods, mackintosh sheetings, etc., necessitates "cold curing" which will be described later; in this case the sulphur for vulcanising is employed in the form of sulphur chloride—a liquid—in a dilute solution in some organic solvent such as carbon bisulphide.

These goods are known as "dipped goods" as the articles are made up by dipping the goods in the dilute sulphur chloride bath.

Mixing or Compounding Substances.

Although the capacity of rubber for taking up large quantities of mineral and other substances has been utilised to such an extent that the process has amounted, in some cases, to actual adulteration, this is by no means the sole idea underlying the compounding of rubber and other substances in the manufacture of vulcanised articles, since, for many purposes, rubber mixings containing only added sulphur may be of little or no use.

I need scarcely state that sulphur is the essential vulcanising agent and I do not propose to discuss here the various theories which have been put forward to explain the reaction which takes place between the rubber and sulphur.

Mineral powders are used not only as "fillers," to add to the mechanical strength, resistance to abrasion, etc., but, in some cases to accelerate the vulcanising action of the sulphur.

It has been said that the art of the soap maker consists in solving the problem of how to make a column of water stand erect; the same remark may perhaps be applied to the manufacture of low grade rubber goods, *viz.*: the addition of sufficient rubber only to cause the mineral ingredients to adhere together.

On account of the difference of price between raw rubber and the compounding material the proportion of the latter in a mixing may represent the profits or success of one manufacturer over his rivals.

This adulteration—for such it may be described, when carried to excess, has, in many instances, led to the rejection of rubber for specific purposes, and the substitution of other materials, to the injury of the trade in general.

The commoner chemicals used for compounding purposes are as follows:—

Antimony sulphide (Golden antimony). Baryta.
French chalk (Talc). Magnesium oxide (light and heavy).
Lime (Calcium oxide). Litharge (Lead oxide).
Lamp black. White lead (Lead oxide).
Zinc oxide. Lithopone (Zinc oxide and Barium sulphate).
Sulphur. Colouring matters.
Sulphurised oils. Balata, Pontianak, etc.
Paraffin and waxes, Bitumen, etc.

Apart from the addition of chemicals, two or more grades or species of rubber may enter into the composition of a particular mixing.

I propose to deal first with the general processes of mixing or compounding, calendering and vulcanising, before describing the methods of manufacture of any particular class of articles.

The Process of Mixing.

In each factory, as a rule, the employee is engaged continually on one particular branch of work, and thus becomes very expert in his own special branch, while probably having little or no knowledge of the other departments; thus, a workman may be in charge of the weighing out of the chemicals, another entirely supervising one or more mixing machines, others in charge of calenders and others watching the vulcanising pans and presses, and so forth.

The operation of mixing is one requiring a considerable amount of care and experience, as the writer has ascertained for himself by actual experiment, since each particular rubber must be mixed at a temperature and for a period depending on the species or grade and the physical properties of the raw material.

The operation consists essentially in obtaining a perfectly homogeneous mixture of the raw rubber and the sulphur and other chemicals used as fillers. This appears to be perfectly simple, but is by no means so in practice, since a mixing, although rendered perfectly homogeneous, may be worked either for too long a period on the rollers or at too high a temperature, and thus become entirely useless.

It should be stated that the mixing rollers are smooth and are usually run at differential speeds; they are hollow and can be heated by steam or cooled by water as required.

The front roller is usually kept slightly warmer than the back so that the rubber mixing adheres to the front roller, where it can be handled more easily.

The raw rubber is first passed between the rollers and heated up slightly, to render it plastic, and the mixed powders, etc., are then added gradually or at once according to the proportion used, being spread as evenly as possible over the sheet of rubber.

In some cases the sulphur is added separately towards the end of the operation to prevent or lessen any vulcanising action which might take place owing to excessive heating of the rollers.

The plastic mixture is then kneaded between the rollers till homogeneous, the desired stage being known by the mixing operator from long experience at this work.

The plastic mass on the front roller is cut from time to time with a sharp knife, on the rollers, and folded over to obtain a thorough mixing of all portions. A tray beneath the rollers serves to catch the chemicals which escape being held by the rubber during the first few passages through the rollers and these are returned to the mixing till the whole is incorporated; each operator is supplied with a small hand brush and scoop to remove the powders from the tary.

It is essential to weigh out all the chemicals carefully, especially the sulphur; this is usually done in a special room and the mixture of powders handed over to the operator supervising the mixing machine; in this way the composition of the mixture can more easily be kept secret.

The temperature of the rollers depends on (1) the quality or species of rubber used, (2) the proportion of "fillers," (3) the nature of the article to be made.

Fine Hard Para can be "worked" at a considerably higher temperature than other species or grades. Plantation crepe and sheet (except perhaps the highest quality of smoked sheet), are somewhat softer—due probably to excessive working in estate factories, methods of coagulation and other causes, and cannot be mixed at such high temperatures. Highly resinous rubbers require very little heating on the rollers. By careless treatment on the mixing rollers, due to too high a temperature or too prolonged working on the rollers, a batch may be spoilt entirely. In some cases, if the batch is only slightly overworked, it may be put aside for some days, when it partly regains its "nerve."

It is very interesting and instructive to observe the plastic condition produced in the raw rubber as a result of the "working" on the hot rollers. The rubber appears to almost suddenly undergo a peculiar change, at which point it becomes very transparent like seaweed.

As a rule, the compounded rubber is allowed to rest for a while before being calendered and becomes quite hard and firm on cooling to ordinary atmospheric temperature.

Before calendering, it must be reheated, to render it sufficiently plastic for passing between the calender bowls or rollers, as if the mixing is too cold and not easily kneaded, it will not spread evenly on the canvas on which it is rolled and the latter may even be torn in the process of calendering. A special machine, similar to the mixing machines, is usually employed for reheating the compounded rubber, preparatory to calendering.

The chemicals used for compounding must be in a fine state of division and free from moisture (they are often dried in vacuum driers in the rubber factory) and care has to be taken in heating the mixing rollers, to prevent caking of the powders.

These mixing machines are very similar in design to the sheeting machines on estates, but generally much larger and heavier in design, while the rollers are hollow and are differentially geared.

Calendering.

The next operation in the manufacture of both hard and soft rubber goods is the process of calendering. The essential idea of this operation is to convert the compounded rubber into a thin smooth sheet of even thickness—the thinness and smoothness of the sheet depending to a certain extent on the article which is to be built up from it. If articles were moulded direct from the compounded rubber, as it comes from the mixing machines, they would be found to be very porous, owing to air bubbles enclosed in the mixture. These air bubbles are observed by the loud " cracking " or explosion which is continually taking place in the rubber on the mixing machines while the compounding is being carried on.

The rollers of the calenders can be set at any convenient distance apart to obtain the desired thickness of sheet, this is done by means of screw or worm gearing as in machines used on estates.

Calenders usually consist of three plain rollers, placed vertically above each other; the top and middle rollers run at differential speeds with respect to each other and the middle and bottom rollers at even speed with respect to each other—all three rollers are running at the same time, although in different directions. The top and middle rollers can also be arranged to run at even speeds on the same machine, if required.

It is very important that the rollers during an operation should run at a uniform speed, otherwise the thickness of the rubber sheet may vary along its length. The top and bottom rollers are adjustable and the middle roller is fixed.

Each roller is hollow, as in the mixing machines, and supplied with steam and cold water pipes for heating or cooling.

In addition to the rollers, a metal reel, often covered with a wooden casing, is placed on a frame, on each side of the machine. The canvas on which the calendered sheet is rolled is wound on one of these reels, passed between the middle and lower roller and wound slightly on the other reel till taut. The hot plastic compounded rubber is passed in small quantities at a time between the top and middle bowls of the calender, adheres to the middle roller which is made slightly warmer than the top roller, passes between the middle and lower roller and adheres to the canvas between the middle and lower roller; as soon as the thin sheet of rubber reaches the canvas, it automatically unrolls the canvas from one reel and an operator at the other reel assists in winding the canvas and rubber round the other reel. If the rubber is too cold and hard the canvas may be twisted and tear and become incorporated with the calendered sheet; on the other hand if the canvas be too tightly stretched the rubber sheet may be twisted and have to be recalendered. A brake is applied to the reel from which the canvas is unwound to regulate the tightness of the canvas and experience only can enable an operator to carry out the process of calendering successfully.

To obtain a sheet of a definite width, adjustable guides are attached to the calender bowls. The canvas on the reels must be very evenly wound, as any twist or fold causess a similar defect in the calendered sheet. The difficulties attending the operation of calendering were demonstrated to the writer when carrying out experiments at the Dutch rubber testing station at Delft in Holland, although after a few attempts, fairly successful results were obtained.

The roll of canvas and rubber is unwound after it becomes cool; thicker sheets may be built up by doubling and trebling the calendered sheet and running it between the middle and bottom rollers on the canvas only.

In some cases, the calendered sheet is cut directly on the calender, by means of a series of knives; this is done in preparing insulating material for cables, etc.

Spreading calenders are used for impregnating fabrics, etc., in the preparation of waterproof materials; in these machines the rolls run at differential speeds in order to give the maximum spreading effect.

All the above remarks apply to materials which are subjected to hot vulcanisation.

Vulcanisation.

The final operation to which all rubber goods are subjected is that of vulcanisation. All mechanical goods, moulded articles,

tyres, hose, belting, rubber heels and soles, tiling, etc., are subjected to hot vulcanisation or the "heat cure" as it is sometimes called.

This process may be divided broadly into two classes :—

(1) in which live steam is used, (2) in which dry heat is used, such heat being obtained from steam under high pressure.

The method adopted depends on the article to be made and, in one and the same factory, one sees curing in vulcanising pans in live steam, curing at elevated temperature and pressure in open screw or hydraulic presses, and curing in autoclave presses being used.

It is generally accepted that vulcanisation in live steam is more rapid than the "open cure" in presses, so that the steam, apart from its effect as a heating agent, plays some part in the reaction which takes place.

(1). Press-curing :—

Pressure, as well as temperature is an important factor in curing and large articles can be cured in an open press, where a very even pressure can be applied, *e.g.* rubber belting and flooring.

The writer, when carrying out vulcanising experiments in Holland, found that the great disadvantage of the open press was the difficulty of obtaining an even temperature over the plates, owing to losses by radiation and steam condensation. The outside of the plates are cooler than the central portions and if certain precautions are not taken to run off the condensed steam, one plate may be hotter than the other, causing over or under vulcanisation on the opposite sides of the article being cured—similar defects may be produced in the central and outer portions of an article under the press.

This disadvantage is not found apparently in works, as no presses, seen by the writer, were jacketed or lagged in any way; correct adjustment is probably a matter of experience. Some text-books state that lagging is practised in factories, to prevent radiation.

It should be stated that in the open press cure, the calendered sheet, built up to the necessary thickness and placed in suitable moulds designed for the particular article, is placed between hollow plates which are heated by steam; the plates are pressed on the moulds by means of a screw or by hydraulic pressure; it goes without saying that only flat articles, or articles which can be placed in flat moulds can be cured in an open press, since the plates of the press must be in thorough contact with the mould.

Articles which have to be made in irregularly shaped moulds must be vulcanised in steam pans or in the autoclave press.

Very thick articles also are not satisfactorily cured in an open press, owing to loss of heat between the plates of the press.

The temperature of the plates is observed either by means of thermometers or pressure gauges.

2. Curing in autoclave presses :—

During recent years the autoclave press has come more into use. This apparatus consists of a hydraulic press, steam being admitted as in the ordinary live steam vulcaniser.

The use of the autoclave press ensures an even temperature throughout the material to be cured, when compared with curing in an open press.

The autoclave press combines the special advantages of the open press and vulcanising pan, and the curing is carried out in dry heat, the steam being admitted to the jacket of the press only.

3. Curing in live steam :—

It is generally admitted that live steam has some action in the process of vulcanisation, apart from the even distribution of heat which is effected by its use; this is confirmed by the fact that articles vulcanised correctly for a definite period at a certain temperature in live steam, are found to be undervulcanised when subjected to similar conditions in an open press.

Some mixings, of course, are badly affected by curing in live steam and must be vulcanised in the press.

As one can easily observe on the other hand, moulded goods of irregular shapes, *e.g.*, motor and cycle tyres, balls, hose, etc., which are vulcanised in special moulds, have to be cured in live steam digesters or in autoclave presses, the moulds being screwed tightly together before placing in the vulcaniser.

The apparatus used for curing in live steam is known as a vulcanising pan; steam is admitted through perforated pipes.

This vessel is often jacketed and steam at a slightly higher pressure is admitted to the jacket, in order to prevent condensation of the steam in the interior.

All vulcanising pans, open presses, and autoclave presses, are provided with pressure gauges or thermometers and the period of vulcanising is kept accurately by an operator who may be in charge of one or more vulcanisers at the same time. The duties of this operator are to regulate the temperature and pressure and period of cure according to instructions received.

The arrangement of the vulcanising shop appears to vary in different factories, some having a vulcanising room attached to each different department, while others have one central shop; this is a problem of organisation or economy only.

Cold Vulcanisation.

Cold vulcanisation is usually carried out on proofed articles, *i.e.* fabrics, etc., on which a thin layer of raw or compounded rubber is

spread. Articles containing colouring matter, pigments, etc., which would be destroyed by heat are also cold cured.

A 2 to 3 per cent solution of sulphur chloride in carbon bisulphide is generally used for the purpose.

The fabric is coated with a thin layer of rubber in a spreading machine which consists of a long metal chest through which steam is passed with an adjustable roller at one end and a gauge. The cloth to be treated is passed through the gauge and takes up a thin layer of the rubber (Pure dry raw rubber is dissolved in naphtha or other solvent to form a paste). The solvent evaporates as the fabric passes over the steam-heated chest, and the process is repeated till the requisite amount of rubber has been spread on the fabric.

Calenders with friction rollers have also been used for spreading on fabrics, to avoid the loss of solvent which occurs in the operation described above, and to avoid the dangers of fire and poisonous fumes. In some cases, sulphur and other ingredients are mixed with the rubber, which is subsequently treated with the solvent and the resulting paste spread on the fabric. In this case the fabric is hot cured which is carried out by passing the "proofed" fabric slowly through stoves in which the vulcanisation takes place; the speed of passing the fabric through the stove and the temperature are regulated so that the proofed article is satisfactorily cured by the time it comes from the stove.

Hot curing causes vulcanised articles to darken considerably and where light transparent goods are required, cold curing has to be adopted.

In this case the articles are built up by repeatedly dipping the moulds, on which the articles are made, into a solution of rubber in naphtha, etc., till the requisite thickness is obtained, and subsequently vulcanising in a cold bath of sulphur chloride.

Certain goods are vulcanised in a molten bath of sulphur, or subjected to the action of the vapours of sulphur chloride.

In the manufacture of mechanical goods, in some cases, the articles are made directly in moulds of the shape required, in others they are cut or stamped out of vulcanised sheets. The latter may involve a certain waste of rubber and the former means a large expenditure for moulds.

The above is a description of the general processes employed in all works. Special details of the manufacture of a few of the most important or common articles of trade will be given in the next issue of the Agricultural Bulletin.

(To be continued.)

FUNGICIDES. THEIR PREPARATION AND APPLICATION.

A. SHARPLES.

The extremely important part played by fungicides in the general control of plant disease is fully recognised today. Certain it is that the value of applying a fungicide, such as Bordeaux mixture, is greater with respect to some plant diseases than to others, as in the case of Potato Blight, where the application of this mixture is indispensable in the control of the disease. Up to the present the diseases which prove troublesome to planters in Malaya have not been of the type, in which the use of Bordeaux mixture would be of much value. Petch in his book* recommends painting the branches of trees attacked by *Corticium javanicum* (Pink disease) with Bordeaux mixture. In view of the number of applications for information as to the manner of combating the spread of pink disease received by the Department and the possible use of fungicides in this connection, a consideration of fungicides is not inappropiate. In any case, in a country dependent to a large extent upon agriculture, first hand information upon this subject is desirable.

The fungicides in common use today, can be divided into two classes.

(1) Fungicides in which Copper is the basis upon which the fungicidal quality depends.

(2) Fungicides in which Sulphur is the basis, upon which the fungicidal quality depends. Dealing with the copper compounds, we will first consider what has proved to be most important of all fungicides, *viz.*, Bordeaux mixture.

BORDEAUX MIXTURE.

Millardet and Gayer first gave us Bordeaux mixture in definite form. Since that time (1882), Bordeaux mixture has been continually used, but only during the last few years have the best formulae and methods of preparation been discovered. Bordeaux mixture consists of varying proportions of copper sulphate (Cu. SO_4), lime, and water.

The proportions of Cu. SO_4, lime, and water in general use is one in which 14 lbs. of Cu. SO_4, 9 lbs. of Lime and 100 galls. of water are taken to make up the mixture. To simplify matters, we may write such formulae as follows Cu. SO_4, Lime, Water,

14. 9. 100.

Bordeaux mixture, made up from these quantities of materials would probably be quite serviceable in the control of "Pink" disease. Planters must remember that the use of Bordeaux mixture against

*Physiology and Diseases of Hevea Brasiliensis.

the spread of Pink Disease, is entirely in the experimental stage, and also that the use of copper fungicides amongst *Hevea Brasiliensis* which is in bearing, must be very carefully attended to, on account of the toxic action of copper compounds upon the Rubber produced from the latex. Other formula for preparing Bordeaux mixture are,

Cu. So_4:	Ca.O:	Water:
8	8	100
12	8	100

Method of Preparation.

Great care must be exercised in the mixing of the materials, and also in their selection, as regards purity of composition. With regard to the copper sulphate an article of 98% purity should be obtained; substances described as "Agricultural Bluestone" or "Agricultural Sulphate of Copper" must be avoided, as these are usually adulterated with Iron Sulphate. The Lime must be "freshly burnt," *i.e.*, in the form of "quick lime." Powdered air slaked lime is useless in the preparation of Bordeaux mixture.

Supposing we wish to make up 100 galls. of Bordeaux mixture of the 8: 8: 100 formula.

(1) Take the 8 lbs. of copper sulphate and tie up in a piece of coarse sacking. Suspend this in 50 galls. of water, from a stick placed across the top of the barrel, by means of a string. The water must be contained in a wooden receptacle. If left overnight till the following day all the copper sulphate will be dissolved.

Place the 8 lbs. Quick Lime in a bucket, take the other 50 galls. of water and from this add a few pints of water to slake the lime. Care must be taken not to add too great a quantity of water at first, just sufficient to produce a thick creamy paste. Now add the rest of the 50 galls. of water. In this way we obtain 50 galls. of Milk of Lime.

Now pour the Milk of Lime into the Copper Sulphate solution, through a coarse sieve, if possible, in order to prevent any undissolved lumps of lime getting into the mixture. The mixture of the two substances results in the production of a flocculent precipitate of minute particles of insoluble basic Copper Carbonate.

Upon the nature of this precipitate of basic Copper Carbonate, depends the fungicidal qualities of Bordeaux mixture. This precipitate varies greatly according to the method of mixing.

The aim, in preparing Bordeaux mixture, is to produce as fine a precipitate as possible, of basic Copper Carbonate. The smaller the particles precipitated, the better the mixture will be, for the particles will not settle so quickly in the spraying machine, and the "Nozzle," upon which, much of the success of spraying with Bordeaux mixture depends, is not so easily choked up.

It is highly important that the copper sulphate and Quick Lime should be dissolved and diluted before mixing. On no account must Bordeaux mixture be made by adding strong copper sulphate solution to a strong mixture of lime, and then supplying the required quantity of water.

This is the method usually adopted in making Bordeaux mixture. Recent investigation at Woburn Experiment Station by Mr. Spencer Pickering have resulted in the discovery of what is claimed as a superior method to that described. The method involved is to make the copper sulphate solution as strong as possible, taking first sufficient water to dissolve the whole of it. Then the rest of the water, according to formula, is added to the Quicklime, that is, the Quicklime is taken in as weak a solution as possible. The Milk of Lime so formed is stirred up several times within half an hour, to dissolve as much of the lime as possible. Then the milk of Lime is allowed to stand for a little time in order that the grosser particles might settle. After standing, *the copper sulphate Solution is added to the Milk of Lime.*

This method of mixing has this practical advantage. It renders possible the use of galvanised iron receptacles, for by pouring the Cu. SO_4. Solution in the middle of the milk of Lime contained in such a receptacle, insoluble basic copper carbonate is formed in the middle, the copper sulphate solution, as such, never reaching the sides.

If the above instructions are followed carefully, anyone can depend upon obtaining a well prepared Bordeaux mixture, and no difficulty ought to be experienced, due to "choking up of the nozzle, as a result of the formation of large particles in the "Bordeaux mixture."

In order to test the quality of the mixture, if we are not certain that enough Lime is present, a clean blade of a penknife, or better, an ordinary French wire nail, if dipped in an unsafe mixture in which there is free copper sulphate present, will result in a film of copper being deposited on the article used. This test will detect 0.05% copper sulphate.

A more sensitive chemical test, is to make up a 10% to 20% Solution of Potassium Ferrocyanide:

Take some of this Solution in a clean saucer and add a little of the "Bordeaux mixture." Should a reddish brown precipitate be thrown down it indicates the presence of free copper sulphate in the mixture, and more Lime must be added till all the copper sulphate is neutralized, and there is no further precipitation.

Previous to pouring in the spraying machine, it is essential that the mixture should be well strained, for as stated previously, it is necessary in spraying with "Bordeaux" to use a nozzle with a very

fine opening to obtain the best results. The best strainer is one of copper gauze with very fine meshes. Well strained "Bordeaux mixture" will easily pass through nozzles which throw the finest 'misty' spray.

The "Bordeaux mixture" made up as described, contains an excess of Lime over the copper sulphate. Resulting from the investigations at Woburn Experimental Farm, Pickering describes a method of making up a mixture, in which the amount of Lime taken is just sufficient to neutralize the copper sulphate, i.e. *Bordeaux mixture with no excess of Lime.* This is the so called "Woburn Bordeaux" and Pickering claims that this mixture is of equal fungicidal strength to that of a mixture in which 16 lbs. of copper sulphate is used, made in the way described above. As only 6 lbs. 5 ozs. of copper sulphate are necessary in this case, there is undoubtedly a great saving. It would be difficult for the planter to make "Bordeaux" by this method, but the mixture can be obtained in "Paste form." It is known as "Weburn Bordeaux Paste," and sold by Voss & Co., Carlton Works, Millwall, London.

This mixture is undoubtedly superior to other ready made powders, and can be recommended for use, although from experiments performed, it appears to wash off the leaves more easily than the ordinary "Bordeaux."

Planters must be warned against the use of the ready made powders offered for sale, such as "Strawsonite," "Vermosite," etc. As all these powders are much inferior in value to Bordeaux mixture made on the spot and also to the "Woburn Bordeaux Paste." These ready made powders are simply the dried precipitate of Bordeaux mixture, and usually contain Cu. $(O. H.)_2$.

The inferiority of these powders is due to the fact that the mixture formed from them contains large particles which sink rapidly. The experiments of R. J. Moss in 1900 conclusively prove that the particles formed in "Bordeaux" made from ready made powders are large and sink rapidly, therefore making an unsuitable mixture for spraying. Not only is the spraying made more difficult by frequent clogging of the nozzle, but more important, the adhesive properties of the Bordeaux, with regard to the plant sprayed, suffer on account of the excessive size of the particles.

The first experiment consisted of comparing the rapidity of sinking of the particles in "Bordeaux mixture" made according to printed directions given with one of the ready made powders, and home made Bordeaux. He took two long cylinders of equal capacity and filled them with equal quantities of the "Ready made" and home made Bordeaux mixtures. Each mixture was well shaken and allowed to stand for 5 minutes.

After the expiration of this time, in the "Ready made" the suspended matter had almost entirely disappeared from the upper half of the cylinder, and the amount of copper in the upper half was only 1.6%. Comparing this result with "Home made" he found the percentage of copper left in the upper half after a similar lapse of time was 48.4%.

Another experiment to compare the adhesive properties of the "Ready made" and "Home made" mixtures was as follows. Potato plants were sprayed with both preparations, and later subjected to what might be termed showers of rain artificially produced.

WITH THE READY MADE.

1st Shower removed 46.6% of Cu. from the leaves
2nd „ „ 5.97% „ „ „ „ „
Total removal of copper 52.57% „ „ „ „ „

HOME MADE MIXTURE.

1st Shower removed 2.92% of Cu. from the leaves
2nd „ „ 3.65% „ „ „ „ „
Total removal of copper 6.57% „ „ „ „ „

These experiments undoubtedly prove the superiority of the Home made mixture.

BORDEAUX INJURY.

Although hardly likely to concern planters in Malaya, mention must be made of "Bordeaux Injury." In using "Bordeaux mixture" against "apple scab," many varieties of apples have their foliage injured. The actual cause of this "injury" is still a moot point, many complicated chemical questions being involved. A detailed consideration of these questions is superfluous at this point, it is sufficient to call attention to the fact that in some cases, an application of Bordeaux mixture may result in definite injury to the trees sprayed, so that planters inclined to use Bordeaux mixture in this country, must not do so in any haphazard manner.

APPLICATION OF BORDEAUX MIXTURE.

Important almost as correct mixing, is the proper application of Bordeaux mixture. It is absolutely necessary in spraying with this fungicide to see that the spray, is applied as a fine "misty" spray, in order to obtain the best results. The "mistiness" of the spray depends upon the type of "Nozzle" used. "Nozzles" which allow the spray to escape in the form of small jets are entirely useless for spraying. The finer the spray, the more closely does the film of the Bordeaux mixture adhere to the leaves.

"Bordeaux Nozzles."

(1) According to Mr. E. S. Salmon ([1]) of Wye Agricultural College, the best Bordeaux nozzles are the "Vermorel" and its modifications, the "Mistry Junior" of American make; the "Mistifier Junior" and the Multi-spray (of English make) and the "Spramotor" nozzle of Canadian make. All these nozzles are obtainable in England. ([2])

A consideration of "Spraying machines" may be left to a later article, when the various fungicides have been dealt with.

The next "copper" fungicide in common use is one in which Washing Soda ($Na_2 . CO_3$) replaces "Lime" in Bordeaux mixture. This "Burgundy" or "Soda Bordeaux" has been found useful in spraying potatoes, and is recommended by the Irish Board of Agriculture, as preferable to "Bordeaux mixture" in combating Potato Disease. The proportions commonly used in mixing are.

	$Cu. SO_4$.	$Na_2 . CO_3$.	Water.
(1).	12 lbs.	15 lbs.	100 galls.
	14 ,,	17½ ,,	100 ,,
(3).	20 ,,	25 ,,	100 ,,

"Soda Bordeaux" is made as follows. The sodium carbonate is dissolved in the proportion 2 lbs. to 1 gall. of water; the rest of the water is used in dissolving the required amount of copper sulphate. Now pour the sodium carbonate solution into the copper sulphate solution. It is necessary to test the acidity of the mixture by means of litmus paper, and if any trace of acidity is noted, more "Soda" must be added, till the acidity is completely neutralized.

Another preparation used occasionally is Cupran. It has been recommended in the United States of America for late spraying of apples, but it is of little practical importance.

Such are the commoner "copper" Fungicides; "Bordeaux mixture" has superseded all others in general use, and in the case of "Pink Disease," it will probably be found to be of value in preventing its spread. Certain experiments have been conducted by the late Mycologist, but the results have not yet been published. Further experiments in the use of Fungicides against *Corticium Javanicum* will be carried out, in order to test the value of Fungicides, other than those containing copper, for in using copper fungicides amongst Hevea trees in bearing, there is always the danger of the latex be-

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(1) On the making and application of Bordeaux mixture. E. S. Salmon.

(2) The vermorel nozzle can be obtained from C. Clarke & Co., 164 Bevis Marks, St. Mary Axe, London, E.C. The "Improval Vermorel" and "Mistifier Junior" from Drake and Fletcher, Maidstone, the "Mistry Junior," and "Improved Vermorel" from Duke and Ockenden, 126 Southwark St., London, S.E., and "Spramotor" from F. Greenhous, Pershore, Worcester.

coming contaminated. If the "sulphur" fungicides are of any value in this connection, they will be the safer to use. A consideration of "sulphur" fungicides and a general survey of the subject of spraying machines will be undertaken in some future issue.

Any person desirous of further information on this subject may refer to the leaflet issued by the South Eastern Agricultural College, Wye, on the making and application of Bordeaux Mixture: by E. S. Salmon F.L.S. Hon. F.R.H.S.

NOTES ON INSECT PESTS.

By C. B. Holman-Hunt.

With the exception of Locusts few insects have been reported as prevalent this month and even that pest seems to be diminishing in numbers generally, though they are more abundant in some localities such as Kuala Pilah and Kajang.

Mr. Ernest E. Green in a Ceylon Circular has mentioned the grub of a large Longicorn beetle as attacking the roots of rubber trees in that island. As there is a common beetle in Malaya closely allied to it, planters are warned to keep a careful look out for it. The Malayan species referred to is 2 in. long with antennae (horns) 4 in. long consisting of 10 segments swollen at the end of each joint. The head is placed at right angles to the body and possesses very strong biting mouth parts. The thorax has a prominent spine on each side and the wing cases small thorns behind and on the outer edge in front. The head, thorax and legs are blackish grey but the thorax has a variably shaped horseshoe mark in red on the vertex. The wing-cases are light brown mottled with darker brown. When caught this beetle squeaks loudly, probably by rubbing the thorax against the front of the abdomen. There are other species of this genus to be found here, but they all have the long horns with swollen joints and the lateral spines on the thorax. The grubs feed for four or five years in living wood and are a dangerous pest to trees. Affected trees may be recognised by the death of the leaves and branches and the grub will be found inside the roots. All affected trees should be burned and the pest destroyed whenever seen.

VARIETIES OF PARA RUBBER TREES.

The *India Rubber Journal* of March 1, 1912, contained an interesting abstract of part of the report of the Commission appointed by the Brazilian Government to visit the chief plantation rubber, producing countries of the East.

A statement contained in the report, which aroused a certain amount of interest in Malaya, was to the effect that all the plantation rubber trees in the Orient belong to an inferior variety of *Hevea*, known in Brazil as the "white" variety, while the best rubber in Brazil is produced by trees of the "black" variety. The only exception it was stated were some 200 trees at Pasir Oetjing in Java.

In view of the high price our plantation rubber has always fetched and the statement by Dr. Huber, at New York, that our trees were of the same kind as those producing the best rubber in Brazil, the above statement did not cause great uneasiness.

It seemed, however, better to make whatever enquiries were possible and see to what extent the statement was true.

Dr. C. J. J. van Hall, Chief of the Division of Botany in the Department of Agriculture, Java, has very kindly made enquiries regarding the trees at Pasir Oetjing with the following results :—

"All the Hevea trees on this plantation, except the oldest ones planted thirteen years ago, originate from seeds from Valombrosa and other estates in Malaya. No difference can be distinguished between these trees and trees on other estates in Java. The thirteen year old trees number about 1,500, they were raised from seed bought from Godefroy-Lebeuf (Paris), who obtained the seed from Brazil.

"Dr. Rutgers went to Pasir Oetjing to investigate these trees. Their appearance is a little different from the common type, their bark being very smooth, and more greyish or whitish than is usual ; the bark is thin. The yield from the trees is poor and decidedly below the average. In the leaves there is about the same variation as there always is among Hevea leaves, and nothing particular could be found.

"It thus appears that a number of trees exist at Pasir Oetjing which had a different origin from the common type, and the appearance of which is slightly different. Their yield is poor. If a special name is given to this variety, it should be "white" not "black." "

In additions to what has been said above the following conclusions arrived at by Sir D. Prain, Director, Royal Botanic Gardens, Kew, will be of interest :—

It is clear that the scientific botanists who are at work in Brazil have not yet been able to come to a common understanding as to the relative economic value and status of the three sorts of "seringueira" spoken of in your letter as *red*, *black* and *white* varieties. But the evidence, such as it is, points to only the *red* as being distinguishable botanically from typical *H. brasiliensis*. The *black* and the *white*, so far as the available evidence goes are not

varieties in a scientific sense ; they appear only to be different states of the same type, the particular state which is of most value being that which grows on higher and drier land than the other.

This last statement of the Commission thus qualified is in complete accordance with what has always been understood with regard to *Hevea brasiliensis* and we have no reason to doubt the strict accuracy of the statement (see Wickham, Para Rubber pp. 5 and 61) that the whole of the *Hevea* seed originally introduced to the East came from trees which grew under the conditions thus indicated by the Brazilian Commission.

L. L. B.

RETURNS REQUIRED BY THE LABOUR DEPARTMENT.

The Controller of Labour desires to draw the attention of all employers of Indian labourers to the fact that all business connected with the immigration of Indians is conducted in Penang. The quarterly returns required for the purpose of calculating assessment as well as all communications regarding recruiting and immigration should be addressed to the Deputy Controller of Labour, Penang.

The returns of labourers locally engaged should be forwarded by estate managers to the office of the Deputy or Assistant Controller who is known to visit the estate. All such returns from the State of Perak should be sent to the Assistant Controller, Penang; from Kuala Lumpur, Ulu Selangor and Ulu Langat Districts to the Deputy Controller, Kuala Lumpur; from Klang, Kuala Selangor and Kuala Langat Districts to the Assistant Controller, Klang; from the whole of the State of Pahang to the Deputy Controller, Kuala Lumpur; and from any place in Negri Sembilan to the Deputy Controller, Seremban.

The quarterly returns of labourers required by section 113 (i) of the Labour Code should similarly be sent by each estate manager to the Labour office for the District in which the estate is situated.

If employers of labour will be good enough to address their communications as indicated above, considerable inconvenience, which is now caused in the Controller's office, by the necessity of forwarding to other offices the contents of numerous envelopes addressed to him, will be avoided.

HOW TO DISTINGUISH DIFFERENT ORDERS OF INSECTS IN THEIR VARIOUS STAGES.

Hemiptera.

By C. B. Holman-Hunt.

These are four-winged insects with sucking mouthparts. They undergo an incomplete metamorphosis.

Hemiptera are sub-divided into

i. Heteroptera; with a jointed beak and the forewings thickened at the base.

ii. Homoptera; with a jointed beak and the forewings of the same thickness throughout.

iii. Parasitica; with a fleshy unjointed beak and without wings. This suborder is parasitic on mammals.

The first two suborders contain many insects of great interest to the agriculturist but their classification is hardly likely to prove of interest to the general reader, so mention will only be made of those which are likely for various reasons to have attracted his attention.

The following are a few of the Heteroptera.

The Water-boatman is probably well-known as well as the Back-swimmer, both of which are common in all pools. The former rows itself about face downwards while the latter paddles about rapidly on its back.

The Water-scorpion, which possesses two bristles which can be united to form a breathing tube at the end of the body, so that this insect can lie immersed in water while still breathing the air above. This enables it to watch its prey under water. If often comes to light.

The Great Water-bug is nearly allied to this. It is named Belostoma and is a fairly frequent visitor to light in this country and also in India. It lives in ponds and other patches of water and feeds voraciously on other insects, fish and frogs.

The Water-striders or Hydrobatidae are long-legged Bugs that run rapidly on the surface of water.

There is a Bug with long legs and the first pair of legs shaped like those of a Mantis. It is predaceous on other insects and belongs to the Emesidae.

The Reduviidae are very aggressive Bugs and when one is collecting at light they will often fly at ones hand and inflict a painful bite. In the nymphal stage they cover themselves with dust so as completely to hide their true form.

The Aradidae are the flat Bugs that can generally be found under the bark of trees.

The Lace-bugs or Tingitidae possess most delicate white wings that appear like fine lace under a magnifying glass. They do some damage to their host-plant.

The Bed bug, Acanthia lectularia, does not possess wings.

The Pentatomids include the numerous Bugs, of which the upper surface of the body is divided into five more or less triangular patches, often diversely coloured.

The Coreidae have the upper surface similarly divided but they can be distinguished by a marked difference in the arrangement of the veins.

The Pentatomidae are known as the Stink-bugs in America on account of their prevailing odour being unpleasant.

The Negro-bugs have the upper surface extremely convex aud are usually dark with a strong green or blue metallic lustre.

The Homoptera include the following insects.

The Cicadas with large transparent wings and large hollow bodies. They are more often heard than seen, though the nymphal cases with their large foreleg cases are often found attached to the trunks of trees. These insects are said to remain several years in the nymphal stage. The Nymphs feed on roots.

The Lantern-flies or Fulgorida have the front of the head produced into a long blunt horn, which is sometimes luminous.

The Spittle-insects or Cercopidae in the nymphal stage blow bubbles in sap to hide their bodies.

The Tree-hoppers or Membracidae, grotesque insects with pointed dilatations on their thorax, do but little damage.

The Jumping Plant-lice or Psyllidae, which rarely exceed 1/6 in. long, but can do great damage to plants when they have been allowed to multiply, are best treated with a spray of an emulsion of soap.

The Aphides or Plant-lice are small insects usually traceable on a tree from the army of ants that attend them for the sake of the honeydew, an excretion given off by them which afterwards becomes covered with a black mould. Their life-history is interesting but too complicated to be dealt with here. The best method of combatting them is with a strong soap or soaw and kerosine oil emulsion. Some Aphides are covered with a white waxy excretion. One form *Schizoneura laniger* works on the roots of fruit trees deep in the ground and then the best plan to save the rest of the garden is to cut out and burn the affected tree.

The Aleyrodidae include the Coconut Scale. They differ from the Coccidae the next group in having wings in both sexes. These wings are covered with a waxy powder somewhat like flour from this the name Aleyrodes is derived.

The Coccidae include the True Scale insects and Mealy bugs. The male is always winged in the mature state and it undergoes a

complete metamorphosis. These insects are among the worst enemies that an Agriculturist has to fight. Various emulsions are used to kill these pests. In the case of small trees being affected a tent is put over the tree and hydrocyanic acid generated below this rapidly kills all insect life but if the tent is left on too long or the poison is too strong the tree sometimes dies too. The Mealy bug with its thick waxy coat is especially difficult to keep in check artificially and one is known to feed on Rubber. But there is a Lady-bird beetle which preys readily on it and the caterpillar of one of the wax-eating Galleriidae feeds on the clusters of nymphs. Lecanium nigrum and other species have done great harm to many plants. They can best be kept down with emulsions of kerosine oil.

This is the last of the Articles on Insects. Any specimens will be gratefully received by the Agricultural Department for examination.

MINUTES OF THE ANNUAL GENERAL MEETING OF THE PLANTERS' ASSOCIATION OF MALAYA, HELD ON THE 27th APRIL, 1913, AT THE CHAMBER OF COMMERCE, KUALA LUMPUR.

Present :—Mr. E. Macfadyen, Chairman.
,, G. H. Day, Legal Adviser.
,, H. C. E Zacharias, Secretary.

and the following members from the various Constituent Associations :—

Batu Tiga District Planters' Association.

Messrs. Robt. Jarvis, T. J. Cumming, J. C. McCaul, J. E. Ord, J. G. McCartney, W. S. Reeve-Tucker, C. F. Stewart. H. E. G. Solbe and H. R. Quartley.

Kajang District Planters' Association.

C. Burn-Murdoch, F. B. Kendall, K. G. Furley, Albin A. Mulloy, E. W. King, T. S. Dumbreck, O. P. Dakeyne and C. H. Wilton.

Kapar District Planters' Association.

Messrs. J. G. Cruickshank, E. H. King-Harman, R. K. Walker, L. S. Hawker, W. H. Nicolay, E. A. Ash, B. Case, Noel Fisher and E. W. Harvey.

KLANG DISTRICT PLANTERS' ASSOCIATION.

Messrs. S. C. Yeomans, E. B. Prior, A. N. Symons, H. B. Dudley, E. C. Wakefield, F. A. Trollope, R. N. Hendrie, W. R. Harrison and A. Chapman.

KUALA LANGAT DISTRICT PLANTERS' ASSOCIATION.

Messrs. H. L. Carter, H. L. S. Skeen, F. J. Dupuis, R. W. Munro, E. Macfadyen, and G. C. Ash.

KUALA LUMPUR DISTRICT PLANTERS' ASSOCIATION.

Messrs. C. J. Arnold, F. S. French, F. Clyde Jeavons, H. T. Webb, A. Keightley Smith, V. Utterson-Kelso, E. B. Skinner, A. St. Alban Smith and A. J. Fox.

KUALA SELANGOR DISTRICT PLANTERS' ASSOCIATION.

Messrs. W. Towgood, W. A. Irving, M. E. L. Shand, S. K. Wickwar, and H. Fauconnier.

LOWER PERAK PLANTERS' ASSOCIATION.

Mr. Maurice Maude.

MALACCA PLANTERS' ASSOCIATION.

Messrs. E. O. Butler, T. W. Main and J. M. Campbell.

NEGRI SEMBILAN PLANTERS' ASSOCIATION.

Messrs. A. D. Davidson, E. J. Malim, S. S. Crisp, H. S. Adams, C. Ritchie, and P. W. N. Farquharson.

ULU SELANGOR DISTRICT PLANTERS' ASSOCIATION.

W. de L Brooke, E. Granville Smith and R. Garnier.

HONORARY MEMBERS.

Mr. L. Lewton-Brain (Director of Agriculture) and Mr. J. R. O. Aldworth (Controller of Labour) and

VISITORS.

Dr. C. Lane Sanson, Messrs. Wm. P. Millar, M. C. English, H. G. R. Leonard, J. H. Mansfield (Madura Co., Ltd.) and B. J. Eaton.

1. The Minutes of the Meeting held on January 6th, 1913 are taken as read and confirmed.

2. New York Exposition.

The Secretary informs the meeting that the accounts of expenditure in connection with the F.M.S. Rubber Exhibit at the recent New York Rubber Exposition have been received and that the total expenditure amounts to $18,900.48.

He reports also having, under date February 1st, sent out a further appeal for contributions.

The Director of Agriculture intimates that in addition to the previously acknowledged $750 he had received a further $125.

3. Ghent Exhibition.

The Secretary reads his letter informing the Under Secretary that the Association did not consider it advisable to participate in the Ghent Exhibition.

4. London Exhibition.

Correspondence forwarded by the Under Secretary was read in which it was stated that the F.M.S. Government will not be officially represented at the London Exhibition.

It was resolved to refer the question of participation to the Standing Committee.

5. Semarang Exhibition.

Correspondence with regard to this from the Under Secretary was read. Mr. Skinner suggests that it might be possible for this Association to send one identical exhibit from one Exhibition to the other.

The Secretary replies that the dates of the Exhibitions in London, Semarang and San Francisco will be respectively June 1914, September 1914 and 1915.

Resolved to leave the matter in the hands of the Standing Committee.

6. Telephones.

Correspondence was read in which the Government informed the Association that the Railway Stations at Klang, Kajang and Seremban will be connected with the exchanges at those places.

Mr. Macfadyen considered that the result of the steps taken by the Association was quite satisfactory. No doubt members in the three districts would take care that the facility was made use of.

Resolved that the Government be thanked for the concession.

7. Drunkenness.

The Secretary reads a letter from the Colonial Secretary, Straits Settlements, forwarding the following notice which is being printed in English, Chinese and Tamil for distribution to license holders and other persons concerned :—

Notice.

The following rule concerning Retail Liquor Shops will come into force on the 1st April, next.

" Rule 44 (a). All Retail Shop Licenses for premises situated within any area not distant more than two miles from any estate or place where any Indian Labourers are employed shall be issued subject to the following condition, that is to say, no liquor shall, without the previous consent of the Superintendent, be sold to Tamil, Telegu, Malayaman or other labourers from or descended from parents from the Madras presidency of British India."

The Chairman notes with satisfaction the steps taken and the Secretary is instructed to write accordingly to the Colonial Secretary.

Mr. E. B. Skinner asks if any steps had been taken to approach Government with a view to having a definition of toddy.

Mr. Macfadyen replies that beyond writing some time ago to ask Government to examine toddy periodically as a safeguard against adulteration, nothing had so far been done by the Association.

Mr. Skinner then proposes that Government be asked to issue an analytical definition of toddy and to fix its alcoholic strength.

This is seconded by Mr. Burn-Murdoch and passed unanimously.

8. Honorary Members.

The Secretary reads letters from the Controller of Labour, and Mr. L. Wray, I.S.O., thanking the Association for their election as Honorary Members.

9. Telegu Recruiting.

The Secretary reads correspondence relating to the suggested establishment of a Kangany Depot for the direct recruiting of Telugu coolies.

The Controller of Labour reads a paper on recruiting in India.

Mr. Macfadyen thanks Mr. Aldworth on behalf of the Association for his interesting address and added various observations and suggestions as to recruiting licenses and allowances, stating that he hoped the Immigration Committee would take up the recommendation of the Standing Committee of the Planters' Association of Malaya and establish a connection in Telugu country with a direct steamer service between Coconada or Vizagapatnam and Port Swettenham.

10. Labour Code.

(*a*) It was proposed by Mr. King-Harman and carried unanimously, in accordance with Mr. Harvey's suggestion, that the Controller of Labour be asked to prescribe the dates and duration of Tamil Holidays.

(*b*) Mr. King-Harman pointed out an apparent anomaly between § 96 and § 150 of the Labour Code of 1912 relating to the minimum ages, *viz* 16 and 15 years for males and females respectively of coolies competent to enter into contract or agreements under the enactment, and permission to employ Indians, from 14 years upwards under § 150; he stated that assessment was paid on coolies between 14 and 16 years of age, whereas no action could be taken in cases of bolting. Mr. Skinner pointed out that this was brought to the notice of the Government by the Standing Committee, before the Enactment was passed, but the Government were unable to grant a concession.

Mr. Aldworth pointed out that assessment is only levied on work done and no assessment accrues when a labourer has bolted.

On Mr. Macfadyen's suggestion the matter was left to the Standing Committee.

(*c*) Resolutions from the Kuala Langat District Planters' Association and the Ulu Selangor District Planters' Association were respectively submitted as follows:—(1) That Government be petitioned to add a clause to the Labour Code to enable employers of Tamil Labour to arrest absconding coolies at any time or place, without first applying for a warrant. (2) That the attention of the Planters' Association of Malaya be drawn to the fact that under existing conditions Magistrates appear reluctant to issue warrants for the arrest of absconding coolies and that steps be taken to remedy the matter.

It was decided to write to the Government on the subject.

(*d*) The following resolutions from the Kuala Langat District Planters' Association and the Kajang District Planters' Association respectively were submitted.

That the meeting views with dismay the proposal to enforce the section of the Labour Enactment relating to the payment of coolies on or before the 10th of the month, as such early payments are of extreme inconvenience to estates and unsettling to labour.

That the Government be asked to amend the enactment relating to the date of payment of coolies so that it will be legal to pay on the Saturday nearest the 10th in the case of Tamils and the Thursday nearest the 10th in the case of Mahomedans.

It was proposed as an amendment by Mr. Carter and carried, that the word "following" be substituted for "nearest" in the second resolution.

11. Estate Dressers.

The Secretary read a letter thanking the Principal Medical Officer for his assistance in connection with a scheme for Estate Dressers, with which the Association agreed, provided that probationers should enter into a bond to serve an estate for two years before the estate deposits $400.

12. Education on Estates.

A letter was read from the Controller of Labour, F.M.S. dealing with the question of schools on Estates and the views of the Director of Education. The Controller of Labour pointed out that the Association had expressed its sympathy with the movement some eight months ago, and that, as the Government considered the matter urgent, it was desirable that practical steps should be taken, as it might be necessary otherwise for legislative action to be taken by Government.

After a discussion on one or two points the Secretary was instructed to collect the information asked for by the Controller of Labour.

13. Federal Council.

Correspondence was read dealing with the resolution passed by the Association at a previous meeting to the effect that the Association be allowed to submit a name for the approval of H. E. the High Commissioner as the Planters' representative on the Federal Council.

A reply was read from the Acting Secretary to the High Commissioner to the effect that His Excellency was, after careful consideration, unable to accede to the request.

Mr. Cruikshank hoped that agitation on the question would be continued, as it was of vital importance to the Association.

14. Accounts and Report.

The accounts and Chairman's report for the past year were submitted and passed.

15. Election of Chairman for 1913-1914.

Voting for the appointment of a new Chairman resulted in the election of Mr. R. W. Munro, who took the chair vacated by Mr. Macfadyen and thanked the association for the honour conferred on him, eulogizing the work of the preceding Chairman.

15. Election of Secretary.

Mr. Zacharias was again unanimously elected as Secretary.

17. Estimates.

The budget for the current year was submitted by the Secretary and agreed to as printed and circulated.

18. Election of Standing Committee.

The following were elected:—Messrs. E. Macfadyen, E. B. Skinner, A. J. Fox, R. Pears, and H. R. Quartley.

Benevolent Fund Committee.

The following were elected:—Rev. W. S. Kelly, Messrs. E. B Skinner, R. W. Munro, D. W. Gilmour, A. J. Fox, E. Macfadyen, G. H. Day, J. le P. Power, M. Maude, and C. Burn-Murdoch.

19. Javanese Labour.

The Secretary reported having circulated members on February 5th on the subject of a letter from the Controller of Labour, and Mr. Maude read correspondence dealing with the subject of importation of Javanese Labour.

The first letter from Mr. Evans to Mr. Maude contains the following information:—

1. That it would be worth while for a Dutch firm to have an office in the F. M. S. in connection with this subject, if sufficient support from planters was guaranteed.

2. That the Chairman, Planters' Association Malaya, states that considerable numbers of Javanese coolies are employed in Lower Perak and that the demand exceeds the supply, but that in the F. M. S. generally the tendency is to employ more Tamils and that as good a means as any of getting into touch with employers likely to interest themselves in these proposals would be to communicate with the Secretary, Lower Perak Association, since the Planters' Association of Malaya takes no part in the recruitment of labour.

3. That, after visiting Java, support was promised to his firm by officials connected with the labour department there, if coolies were engaged for healthy estates in F. M. S. where they would be well treated.

4. That the Royal Paketvaart Company will institute direct communication between Java and the F. M. S. by making their weekly steamers call at Port Swettenham on the way to Belawan provided certain guarantees as to number of passengers and freight were given by his firm.

5. That 1,500 to 2,000 Javanese coolies per year could be easily recruited and that the passage to Port Swettenham would be the same as to Deli.

6. Railway fare from Port Swettenham to Telok Anson to be $1.43 or one cent per mile for immigrant coolies on first arrival from port of destination on filling up a form signed by the Immigration Agent or other Official concerned.

Initial cost of labourers at that time was :—

f.o.b. Semarang (including advance *f* 5)	*f* 85
freight Semarang to Port Swettenham ...	*f* 15
Fees for firm	*f* 10
c.i.f. Port Swettenham	*f* 110

7. That the firm would for this fee of *f*10 obtain licences from the Dutch Government, obtain the best labourers, and advise planters on the subject of recruiting Javanese, with the promised support of the Dutch Consul General.

The following information was asked for by Mr. Evans.

a. Which Companies have Dutch Government licences and how many coolies would these estates require ?

b. Which Companies would like to get permission from the Dutch Government to engage Javanese coolies ?

c. Would these latter Companies entrust the firm again to obtain them licences and how many coolies would they take at once ?

d. Are there any Companies holding such licences who have no intention of using them and would they have them cancelled on behalf of other members of the Association ?

A letter was also read from the Manager of the Labour Association, Ltd., stating terms on which they would import "free" Javanese coolies.

1. A fee of *f*10 (= $7.20) per head would be required to house the coolies in Batavia, ship from Java, receive and house in Singapore and reship from Singapore to destination.

2. Actual out of pocket expenses for food at Singapore and watching on route to be fixed by arrangement, would be approximately $3 to ports north of Malacca and $2/50 to Malacca.

3. In addition actual passage money as follows :—

Penang $1.50, Telok Anson $3.50, Port Swettenham $1.50, Port Dickson $1.50, Malacca $1.00.

4. Total cost to port of destination from depot in Batavia would therefore be, including commission : Penang, Port Swettenham or Port Dickson $12 each, Telok Anson $14, Malacca $11.

5. These charges include service of depot at Batavia, but not food in depot which would be by arrangement.

6. The depot at Kallang, Singapore, accomodates 200 through coolies and is the largest in Singapore.

7. The coolie depot at Batavia will be ready in good time for the scheme.

8. All arrangements would be made with the approval of the Consul General for the Netherlands and the Netherlands Indies Government.

It was resolved that the Standing Committee be asked to deal with the matter.

20. Standardization of Rubber.

Mr. Macfadyen thinks most of them felt the chief problem now before the industry was to place rubber on the market. They had got beyond the stage when the difficulty of producing rubber was what chiefly concerned them. Rubber was produced in greater quantities every day, and it was even thought by some it would be produced in greater quantities than the manufacturers would be prepared to consume. They might do a good deal with a view to establishing a name for their rubber by starting a testing station in the F. M. S. There was no doubt justification for the criticism that there was a great lack of uniformity in the preparation of rubber, and if they had a testing station under Government prepared to discover the truth about plantation rubber, to find out what conditions were wanted to make rubber valuable, as far as such discoveries could be made by means of chemical analysis, they would make a considerable stride towards establishing of Malay States rubber on the market as a rubber of known and fixed qualities. It would be very interesting if the Director of Agriculture cared to offer any remarks on the subject. He happened to know that the Director of Agriculture had considered the matter very thoroughly, and if he was not mistaken, had advocated the addition to the staff of the Agricultural Department of several chemists, some of whom would be engaged on testing rubber at the testing station, whilst the rest would be travelling round estates advising planters on the method of working their factories, discovering which systems, of the many introduced, produced the best results, and generally in bringing the knowledge gained in research work in Kuala Lumpur into contact with the management of factories on estates.

Mr. Lewton-Brain said that, as Mr. Macfadyen had pointed out, the great question now was to get some sort of idea of the quality of rubber they were turning out here. At present all they knew was that manufacturers grumbled and said it was not standard, that they bought one sample and had to use it in one way, and when they bought another lot had to use it in a different way. Probably they were correct. It was for this country to discover some way of getting over that. Last year he brought the subject to the notice of the Government, and they approved of expenditure on a vulcanis-

ing plant. All rubber before it was tested had to be vulcanised. Mr. Eaton had made enquiries during his trip to the Continent, and a vulcaniser and testing plant were now on their way out. The question was how they were going to use it. He had suggested to the Chief Secretary that they should employ two extra chemists to work under Mr. Eaton's supervision, and do nothing but work on this question of the standardization of rubber. They would work with the estates, and no doubt the estates would work with them, and find out what was at the bottom of these variations, whether the trees were different, or whether they were due to different methods of manufacture. The Chief Secretary said he would like to have an expression of opinion from the Planters' Association, before going further in the matter, and he would be glad if this meeting would express its opinion on this subject.

Mr. Munro thanks Mr. Lewton-Brain for bringing the matter forward and agrees that it was one of the foremost importance to the rubber industry. He and every planter could but heartily and fully endorse the steps recommended by the Director of Agriculture.

Mr. Macfadyen then moves: "That, with a view to the standardization of rubber, Government be asked to strengthen the staff of the Department of Agriculture, F. M. S., by the addition of at least two more Chemists."

This motion is seconded by Mr. Munro and carried unanimously.

21. Licensing of Dealers.

Correspondence was read from the Secretary, Kapar District Planters' Association to the District Officer Klang, suggesting the fixing of a date in the Government Gazette for issuing licences to deal and treat in rubber, so that any person wishing to oppose such application might attend on the date fixed.

Mr. King-Harman and Mr. Campbell spoke in support of the suggestion and the latter suggested that the Standing Committee report on the subject.

This was carried.

22. Burial Grounds.

Correspondence from the Secretary, Ulu Selangor District Planters' Association, with reference to the Government charge of $500 for private burial grounds was read by the Secretary.

It was stated by Messrs. Skinner, Farquharson and Arnold that this was a misunderstanding and only applied to private individuals wishing to have a burial place of their own. No action was therefore taken and Mr. Brooke withdraws his motion.

23. GENERAL.

The Secretary lays on the table.

(1). Letter from Ulu Selangor District Planters' Association re handling of rubber at Penang.

(2). Letter from Sepang District Planters' Association.

(3). Annual Report of the Planters' Association of Malaya.

(4). Letter from Commissioner of Trade and Customs re Messrs. Northerte & Co.

The Meeting terminates at 12.30 p.m.

LABOUR NOTE.

The Acting Controller of Labour wishes to bring to the notice of all planters the following remarks recently made by a Magistrate at an inquest held by him upon the death of a Tamil cooly on an estate in his district.

"I consider that in all cases on an estate, of the sudden death of a labourer, or death under circumstances described in section 279 of the Criminal Procedure Code, the Manager should allow the Police an opportunity of examining the body and of taking such action as may be considered necessary, otherwise there is the possibility of a suggestion that there has been failure to comply with the provisions of Part VIII of the Labour Code."

2. In the case in question the Manager ordered the body to be buried and afterwards informed the Police.

3. The Magistrate returned a verdict of "death from natura causes" and stated that he considered the Manager acted in good faith and did all that he considered necessary.

4. He added however, the rider which has been quoted above and which appears to be most desirable to bring to the notice of all Managers of estates.

DEPARTMENTAL NOTES.

Mr. P. B. Richards of the Royal College of Science, London, has been appointed Assistant Agricultural Inspector, Department of Agriculture, Federated Malay States.

Mr. A. G. G. Ellis, has been appointed Assistant Agricultural Inspector, Department of Agriculture, Federated Malay States.

SOIL ANALYSES.

Managers desiring analyses made of soils of their estates for the purpose of arranging manurial trials, etc., are requested not to take the samples themselves but to communicate with the Director of Agriculture, who will arrange that the officer in charge of soil work shall visit the estate, take the samples and make the necessary notes on conditions, etc., himself.

NOTES ON THE SINGAPORE MARKET FOR STRAITS PRODUCE DURING MAY, 1913.

Black Pepper.—With supplies gradually falling off, and an improved demand the price steadily advanced throughout the month, and closed steady at $20.1/8. The Johore crop is now practically finished, and arrivals from that quarter will be small for some time.

White Pepper.—Is also scarce and the price advanced to $35/35½, no improvement being noticable in quality.

Gambier.—The market firmed up very considerably during the month, and with supplies well up to the average, the price advanced to $7.1/4 to $7.3/8 closing however rather easier.

Cube Gambier.—A small business was done in No. 1 Java at $12, and Hamburg quality at $10½ to $10.7/8, there being rather more demand than during April. Malacca Pressed Cubes are still not wanted.

Copra.—After opening quiet with less demand, our market improved towards the end of the month, and closed firm at a considerable advance in price, ready parcels being keenly competed for. Values on 31st May were:—

Bally	... ...	$12-10
Kayong	... ...	11-90
Pulo	... ...	11-90
Siantan	... ...	11-80

Rubber.—The market is decidedly easier since our last advices. Closing values are:—

Fine Pale Crepe	$166
No: 2 Crepe	150
Smoked Sheet	168
Unsmoked Sheet	150
Scrap Sheet	130

Tapioca.—With only small supplies coming in prices have remained the same, business having been done at $6.1/4 for Small Flake and $6.20 for Medium Pearl.

Nutmegs.—No business reported, closing values are $23 for 110*s*. and $24 for 80*s*.

Sago Flour.—An improved demand has set in and prices have firmed up, business having been done at $3.55/$3.60 according to quality.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon, during the Years 1913 and 1912.

Places of Destination.	Exported during April, 1913.	Previously.	Total export during the year 1913.	Export during similar period of previous year.	Increase.	Value of rubber, 1913 to date.	Duty collected, 1913, to date.
	Tons.	Tons.	Tons.	Tons.	Tons.	$	$
Straits Settlements ...	734.69	2,318.94	3,053.63	1,867.70	1,185.93	10,456,021	261,232.31
United Kingdom ...	761.00	2,768.17	3,529.17	2,482.56	1,046.61	12,140,977	303,524.43
Continent of Europe ...	89.69	362.82	452.51	324.86	127.65	1,562,877	39,071.93
Ceylon	40.87	175.53	216.40	155.82	60.58	754,017	18,850.43
Other Countries ...	...	...	...	...	...	...	...
Total ...	1,626.25	5,625.46	7,251.71	4,830.94	2,420.77	24,913,892	622,679.10

KUALA LUMPUR,
20th May, 1913.

W. J. P. HUME,
Commissioner, Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the Month of April, 1913.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Khota Bahru	...	150.	83.	90.20	74.70	15.50	77.7	.843	74.1	74.0	...	1.25	.70
Malacca, Durian Daun Hos.	29.848	150.5	83.	88.3	73.4	14.9	79.2	.950	...	86.	N. W.	7.86	1.97
N. Sembilan, Dist. Hospital Seremban	...	151.6	78.6	87.7	71.9	15.8	76.2	.857	74.6	87.	N. W.	11.63	3.40
„ Dist. Hos. K. Pilah	...	...	80.8	90.3	73.1	17.2	77.2	.866	74.8	82.	...	5.91	1.84
„ „ Tampin	...	169.0	80.8	87.9	74.0	13.9	76.4	.837	74.7	79.	...	4.19	1.04
„ „ P. Dickson	...	161.1	82.2	88.2	75.0	13.2	77.8	.867	74.9	78.	...	3.18	0.96
Pahang, „ K. Lipis	...	...	82.1	90.4	69.7	20.7	74.5	...	...	...	...	13.61	2.03
Penang, „ Penang	29.812	157.	83.1	93.	73.	20.	78.6	.961	72.2	81.	...	3.39	.84
Perak, „ Taiping	...	107	81.42	92.	72.	20.	77.54	.894	...	85.	...	26.97	4.70
„ „ Ipoh	...	...	81.05	91.	71.	20.	77.03	.875	...	83.	...	9.75	3.00
„ „ T. Anson	...	...	82.42	92.	70.	22.	78.16	.907	...	83.	...	13.04	3.30
„ „ P. Buntar	...	...	81.57	90.	70.	20.	77.60	.896	...	85.	...	9.18	3.77
„ The Cottage	...	...	...	...	...	...	...	...	...	...	...	34.44	3.90
Selangor, General Hospital Kuala Lumpur	...	145.7	81.1	89.1	73.0	16.1	77.60	.856	75.2	81.	...	11.02	2.38
„ Dist. Hos. Klang	...	...	...	88.6	64.1	24.5	...	...	...	...	...	5.43	1.03
„ „ K. Selangor	...	...	...	87.8	69.7	18.1	...	...	...	...	...	6.30	2.10
„ „ Rawang	...	...	...	89.9	72.9	17.0	...	...	...	...	...	13.66	1.85
Singapore, Kandang Kerbau Observatory	29.868	158.2	82.1	92.5	72.0	20.5	78.2	.903	...	82.	S. E.	10.99	3.54